

In the claims:

1. (Withdrawn) A method for encoding of digital watermark information in a signal, comprising steps of:

establishing a minimum and a maximum signal value;

determining a quantization interval for a range between the minimum and maximum signal values; receiving samples to be quantized into one of plural quantization levels corresponding to the quantization interval;

comparing samples to the minimum and maximum signal values;

when a potential rail error occurs, adjusting the samples to correspond to a value between the minimum and maximum signal values; and

storing the adjusted samples.

2. (Withdrawn) The method according to claim 1, wherein signal characteristics can be compressed.

3. (Withdrawn) A method for decoding of digital watermark information in an encoded signal comprising steps of:

determining a quantization interval of the encoded signal;

determining minimum and maximum values corresponding to the quantization interval for the encoded signal;

receiving the encoded signal wherein samples within the encoded signal have been adjusted to conform to a limited range of values represented by the quantization interval; and

decoding the received signal to retrieve the watermark.

4. (Withdrawn) The method according to claim 3, wherein signal characteristics can be compressed.

✓ 5. (Withdrawn) A method of encoding and decoding watermarks in a signal, comprising insertion and detection of features in said signal to carry watermark information, wherein said features are mathematical functions of the input frame and adjacent frames.

✓ 6. (Withdrawn) A method of pre-analyzing a digital signal for encoding digital watermarks using a digital filter comprising determining what changes in the digital signal will be affected by the digital filter.

7. (Withdrawn) The method according to claim 6, further comprising a step of encoding watermarks so as to ensure that the watermark will survive the changes introduced by the digital filter.

8. (Withdrawn) A method of error coding watermark message certificates using interleaved codes.

✓ 9. (Withdrawn) A method of pre-processing a watermark message certificate comprising determining an exact length of the watermark message as it will be encoded.

10. (Withdrawn) The method according to claim 9, further comprising a step of generating a watermark key which will provide at least one unique bit for each bit comprising the watermark message.

✓ 11. (Original) A method of encoding a watermark in a digital signal, comprising the steps of:

generating varying watermark key bits; and

encoding the watermark in the digital signal using the varying watermark key bits and characteristics of the digital signal.

12. (Original) A method of encoding a watermark in a digital signal, comprising the steps of:

generating varying watermark key bits; and

encoding the watermark in the digital signal using the varying watermark key bits.

13. (Original) A method of encoding a watermark in a digital signal, comprising the steps of:

mapping key and processing state information to effect an encode/decode map; and

63 encoding the watermark in the digital signal using the encode/decode map and characteristics of the digital signal.

14. (Original) A method of encoding a watermark in a digital signal, comprising the steps of: mapping key and processing state information to effect an encode/decode map; and encoding the watermark in the digital signal using the encode/decode map and characteristics of the digital signal.

15. (Withdrawn) A method of guaranteeing watermark certificate uniqueness comprising attaching a user identification dependent hash of watermark data.

16. (Original) A method of generating a noise signal to produce watermark information, wherein the noise signal is a function of at least one variable which depends on key and processing state information.

17. (Withdrawn) A method of varying a watermark to compensate for dither by changing a concentration of watermarking signal energy between higher and lower frequencies.

18. (Withdrawn) A method of encoding watermarks comprising steps of:  
offsetting at least one portion of the watermark bit stream; and  
encoding at least one instance of the watermark using said offset portion of the watermark  
bit stream.

19. (Withdrawn) A method of decoding watermarks comprising steps of:  
considering an original watermark synchronization signal, an inverted watermark  
synchronization signal, or inverted watermarks; and  
decoding based on the considering step.

20. (Original) A method of encoding watermarks in a signal using a spread spectrum  
technique to encode where the encoding methods is pseudo-random.

21. (Original) A method of decoding watermarks in a signal using a spread spectrum  
technique to decode where the decoding method is pseudo-random.

22. (Original) The method of claim 21, wherein the information is encoded and the  
encoding method is pseudo-random.

23. (Withdrawn) A method of analyzing composite digitized signals for watermarks  
comprising steps of:

obtaining a composite signal;  
obtaining an unwatermarked sample signal;  
time aligning the unwatermarked sample signal to the composite signal;  
gain adjusting the composite sample signal to a corresponding segment of the  
unwatermarked signal, determined in the time aligning step;  
estimating a watermarked sample signal by subtracting the unwatermarked signal from the  
adjusted composite signal; and  
scanning the estimated watermarked sample signal for watermarks.

24. (Withdrawn) A method for varying watermark encode/decode parameters automatically during the encoding or decoding of a watermark comprising steps of:

- a) assigning a list of desired parameters to a list of corresponding signal characteristics which indicate use of particular parameters;
- b) during encoding/decoding, analyzing characteristics of the current sample frame in the signal stream, prior to encoding a portion of the frame;
- c) looking up the corresponding parameter from the list of parameters in step (a) which matches the observed signal characteristics from step (b);
- d) loading and/or preparing the desired parameter;
- e) encoding the portion of the sample frame using the parameter selected in step (c).

25. (Withdrawn) The method according to claim 24, wherein signal characteristics can be compressed.

26. (Withdrawn) A method for varying watermark encode/decode algorithms automatically during the encoding or decoding of a watermark comprising steps of:

- a) assigning a list of desired parameters to a list of index values;
- b) during encoding/decoding, computing the index value for the current sample frame in the signal stream, prior to encoding a portion of the frame;
- c) looking up the corresponding parameter from the list of parameters in step (a) which matches the index value from step (b);
- d) loading and/or preparing the desired parameter;
- e) encoding the portion of the sample frame using the parameter selected in step (c) in combination with an application specific scaling factor.

27. (Withdrawn) The method according to claim 26, wherein signal characteristics can be compressed.

28. (Withdrawn) The method of claim 23, further comprising the step of accessing amplitude information in the watermarked sample signal.

29. (Withdrawn) The method of claim 28, wherein the change in amplitude information represents a variation from the unwatermarked sample signal.

30. (Withdrawn) The method of claim 28, wherein the amplitude information represents a signal characteristic parameter for use in watermark decoding.

31. (Withdrawn) The method of claim 1, further comprising the step of randomly encoding watermark bits in the signal using a digital noise source.

32. (Withdrawn) The method of claim 31, the digital noise source comprises an algorithm digital noise source.

33. (Withdrawn) The method of claim 32, wherein the digital noise source is seeded with a predetermined key.

34. (Withdrawn) The method of claim 31, further comprising the step of spreading watermarking signal energy across a group of pixels to compensate for dithering.

35. (Withdrawn) The method of claim 1, further comprising the step of encoding message bits in the signal using a digital noise source.

36. (Withdrawn) The method of claim 35, the digital noise source comprises an algorithm digital noise source.

37. (Withdrawn) The method of claim 36, wherein the digital noise source is seeded with a predetermined key.

38. (Withdrawn) The method of claim 35, further comprising the step of spreading a watermark signal across a group of bits to compensate for dither.

39. (Withdrawn) The method of claim 15, further comprising the step of using additional bits to verify the user corresponding to the user identification dependent hash.

40. (Withdrawn) The method of claim 1, further comprising the step of adding one or more hash bits to a user set of bits before encoding the watermark.

41. (Withdrawn) The method of claim 1, further comprising the step of randomly varying two or more adjacent frames.

42. (Withdrawn) The method of claim 5, further comprising the step of randomly varying two or more adjacent frames.

43. (Withdrawn) The method of claim 3, further comprising the step of changing an input sample.

44. (Withdrawn) The method of claim 3, wherein a watermark occupies more time than a single frame.

45. (Withdrawn) The method of claim 44, wherein a redundant block code is used to encode watermark bits, such that  $n$  bits are encoded into a block having a length of  $m$  bits, where  $m$  is greater than  $n$ .

46. (Withdrawn) The method of claim 6, further comprising the step of encoding an audio watermark by first determining where watermark bits are inaudibly suited without introducing audible artifacts.

47. (Withdrawn) The method of claim 46, wherein the watermark bits are encoded below the predicted masking level.

48. (Withdrawn) The method of claim 46, wherein the watermark bits are encoded orthogonally.

49. (Withdrawn) The method of claim 7, further comprising the step of encoding an audio watermark by first determining where watermark bits are inaudibly suited without introducing audible artifacts.

50. (Withdrawn) The method of claim 49, wherein the watermark bits are encoded below the predicted level.

51. (Withdrawn) The method of claim 49, wherein the watermark bits are encoded orthogonally.

52. (Withdrawn) The method of claim 6, further comprising the step of encoding an image watermark by first determining where watermark bits are invisibly suited without introducing visible artifacts.

53. (Withdrawn) The method of claim 52, wherein the watermark bits are encoded below the predicted level.

54. (Withdrawn) The method of claim 52, wherein the watermark bits are encoded orthogonally.



53 55. (Withdrawn) The method of claim 7, further comprising the step of encoding an image watermark by first determining where watermark bits are invisibly suited without introducing visible artifacts.

56. (Withdrawn) The method of claim 55, wherein the watermark bits are encoded below the masking level.

57. (Withdrawn) The method of claim 55, wherein the watermark bits are encoded orthogonally.

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58. (Withdrawn) A system for pre-analyzing a digital signal for encoding at least one digital

watermark using a digital filter comprising:

a processor for identifying an area of the digital signal that will be affected by the digital filter; and

an encoder for encoding the at least one digital watermark in the digital signal, the encoder encoding the at least one digital watermark so as to avoid the at least one area of the digital signal that will be affected by the digital filter.

54 59. (Withdrawn) The system of claim 58, wherein the processor operates on the digital signal by selecting an area of the digital signal from the group consisting of a frequency delimited area and a time delimited area.

60. (Withdrawn) The system of claim 58, wherein the processor operates on the digital signal by selecting an area of the digital signal from a bit-depth delimited area.

61. (Withdrawn) The system of claim 58, wherein the encoder ensures that the watermark will survive the changes introduced by the digital filter.

62. (Withdrawn) A system for pre-processing a watermark message, comprising:  
a pre-processor for determining an exact length of a watermark message as it will be encoded; and  
a key generator for generating a watermark key that provides at least one unique bit for each bit comprising the watermark message.

63. (Previously presented) A system for encoding a watermark in a digital signal, comprising:  
a generator for generating a plurality of watermark pseudo-random key bits; and  
an encoder for encoding the watermark in the digital signal using the watermark pseudo-random key bits and characteristics of the digital signal.

64. (Previously presented) The system of claim 63, wherein the generator is selected from the group consisting of a non-linear generator and a scrambling generator.

65. (Previously presented) The system of claim 63, wherein the characteristics of the digital signal  
comprise mathematically defined functions of the digital signal.

66. (Previously presented) A system for encoding a watermark in a digital signal, comprising:  
a mapper for mapping pseudo-random key and processing state information to effect an encode/decode map using a generator; and  
an encoder for encoding the watermark in the digital signal using the encode/decode map and characteristics of the digital signal.

67. (Previously presented) The system of claim 66, wherein the generator is selected from the group consisting of a non-linear generator and a scrambling generator.

68. (Previously presented) The system of claim 66, wherein the characteristics of the digital signal comprise mathematically defined functions of the digital signal.

54 / 69. (Withdrawn) A system for encoding watermarks, comprising:  
an inverter for inverting at least one instance of the watermark bit stream; and  
an encoder for encoding at least one instance of the watermark using the inverted instance of the watermark bit stream.

/ 70. (Withdrawn) A system for analyzing composite digitized signals for watermarks, comprising:  
a first receiver for receiving a composite signal;  
a second receiver for receiving an unwatermarked sample signal;  
an aligner for time aligning the unwatermarked sample signal with the composite signal; an adjuster for gain adjusting the time aligned unwatermarked sample signal to a corresponding segment of the composite signal, determined when the signals are time aligned;  
an estimator for estimating a pre-composite signal using the composite signal and the gain adjusted unwatermarked sample signal;  
an estimator for estimating a watermarked sample signal by subtracting the estimated pre-composite signal from the composite signal; and  
a scanner for scanning the estimated watermarked sample signal for watermarks.

/ 71. (Withdrawn) A method for pre-analyzing a digital signal for encoding a plurality of digital watermarks using a digital filter, comprising:

providing a digital signal;  
providing a plurality of digital watermarks;  
determining an encoding level; and  
encoding each of the plurality of digital watermarks in the digital signal at substantially the same encoding level.

72. (Withdrawn) A method for pre-analyzing a digital signal for encoding digital watermarks using a digital filter, comprising:

providing a digital signal;  
providing a digital filter to be applied to the digital signal; and  
identifying an area of the digital signal that will be affected by the digital filter based on at least one measurable difference between the digital signal and a counterpart of the digital signal selected from the group consisting of the digital signal as transmitted, the digital signal as stored in a medium, and the digital signal as played backed.

73. (Withdrawn) A method for encoding a watermark in a content signal, comprising:  
splitting a watermark bit stream; and  
encoding at least half of the watermark bit stream in the content signal using offsetting instances of the watermark bit stream.

74. (Withdrawn) A method for encoding at least one watermark in a content signal, comprising: predetermining a number of bits in the content signal to be encoded, based on at least one of a fixed length key and signal characteristics of the content signal; and  
encoding the watermark in the predetermined bits.

75. (Withdrawn) A method for encoding at least one watermark in a content signal, comprising:  
locating at least one noise-like signal feature in the content signal; and

encoding the at least one watermark in substantially the same location as the at least one noise-like signal feature.

76. (Withdrawn) A method for encoding at least one digital watermark in a content signal comprising:

measuring a perceived signal-to-error ratio; and

encoding the at least one watermark in a channel bound by a minimum and maximum signal-to-error level for the content signal.

77. (Withdrawn) A method for digital watermark encode/decode comprising the steps of:  
measuring a perceived signal-to-error ratio; and  
encoding at least one watermark in a signal feature that is bound by a minimum and maximum signal-to-error level for the digital signal.

78. (Withdrawn) A method for digital watermark decode comprising:  
receiving a suspect digital signal to be analyzed;  
subjecting the digital signal to a time-based alignment; using the time-based alignment to align amplitude values in the suspect digital signal; and  
decoding a digital watermark.

79. (Withdrawn) A method for encoding watermarks in a digital content signal, comprising:  
identifying a plurality of signal features in the digital content signal; and  
inserting watermark data in the identified signal features; wherein the identified signal features are identified from relationships between multiple sample windows in the digital content signal.

80. (Withdrawn) The method of claim 79, wherein the signal features have logical relationships with an analog waveform represented by the digital content signal.

81. (Withdrawn) The method of claim 79, wherein the signal features comprise mathematical functions of the sample windows.

82. (Withdrawn) A method for decoding watermarks from a digital content signal, comprising: identifying a plurality of signal features in the digital content signal; and decoding watermark data from the signal features; wherein the signal features are identified from relationships between multiple sample windows in the digital content signal.

83. (Withdrawn) The method of claim 82, wherein the signal features have logical relationships with an analog waveform represented by the digital content signal.

84. (Withdrawn) The method of claim 82, wherein the signal features comprise mathematical functions of the sample windows.

85. (Withdrawn) A method for pre-analyzing a digital signal for encoding digital watermarks using a digital filter comprising: identifying at least one of a frequency and a time delimited area of the digital signal that will be affected by the digital filter; and encoding at least one digital watermark so as to avoid the identified area.

/ 86. (Withdrawn) A method for pre-analyzing a digital signal for encoding digital watermarks using a digital filter, comprising:

identifying at least one change to the digital signal that will be affected by the digital filter;  
and

encoding at least one digital watermark so the watermark survives the changes introduced by the digital filter.

/ 87. (Withdrawn) A method for guaranteeing watermark uniqueness, comprising:  
providing a watermark; and attaching a timestamp.

B<sup>4</sup> / 88. (Withdrawn) A method for guaranteeing watermark uniqueness, comprising:  
providing a  
watermark; and attaching a user identification dependent hash to the watermark.

/ 89. (Withdrawn) A method for guaranteeing watermark uniqueness, comprising:  
providing a watermark; and  
attaching a message digest of watermark data.

/ 90. (Withdrawn) A system for digital watermark encode/decode operations, comprising:  
a parameter database comprising a plurality of parameters; and  
a processor which encodes at least one watermark using at least one parameter from the  
parameter database.

/ 91. (Withdrawn) A method for digital watermark encode/decode comprising:  
providing a digital signal stream; using one or more of a plurality of watermarking  
parameters to encode at least one digital watermark; and  
associating the one or more of a plurality of watermarking parameters with a  
predetermined key.

92. (Withdrawn) An article of manufacture comprising:  
a receiver to receive a digital signal;  
a detector to detect at least two of a plurality of digital watermarks located within the digital signal; and  
a processor that enables content signal manipulation of the digital signal based on successful detection of at least two of the plurality of digital watermarks.

93. (Withdrawn) The article of claim 92, wherein the detector also detects a watermark, further comprising: a verification module which verifies at least one detected watermark.

84 94. (Withdrawn) A method for pre-processing a digital data signal to authorize a plurality of unique descendant copies of the digital data signal, comprising:  
providing the digital data signal;  
identifying a plurality of candidate bits in the digital data signal that can be manipulated during embedding;  
generating a digital watermark message to be embedded based on at least one predetermined criterion; and  
embedding the digital watermark message in the plurality of candidate bits.

95. (Withdrawn) The method of claim 94, wherein the step of identifying candidate bits of the digital data signal to be manipulated comprises:  
generating a psychoacoustic model of the digital data signal.

96. (Withdrawn) The method of claim 94, wherein the step of identifying candidate bits of the digital data signal to be manipulated comprises:  
generating a psychovisual model of the digital data signal.



97. (Withdrawn) The method of claim 94, wherein the digital data signal comprises compressed digital data.

98. (Withdrawn) The method of claim 94, wherein the step of generating a digital watermark message comprises:

generating a unique digital watermark message for each authorized descendant copy.

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99. (Withdrawn) The method of claim 94, wherein the criterion are selected from the group consisting of a transaction identification, an individual identification, a use limitation, and a signal domain.

100. (Withdrawn) The method of claim 94, wherein the digital watermark message is encoded in a subset of the plurality of candidate bits identified.

101. (Withdrawn) The method of claim 94, wherein the plurality of candidate bits that are embedded with the digital watermark message have a relationship that creates additional uniqueness of the digital watermark message.

102. (Withdrawn) The method of claim 101, wherein the relationship is at least one of a sequential relationship, a linear relationship, and a logically-ordered relationship.

103. (Withdrawn) The method of claim 94, wherein a subset of the plurality of the candidate bits share at least one function.

104. (Withdrawn) The method of claim 103, wherein the function is selected from the group consisting of mapping, error correction, and signal processing.

105. (Withdrawn) The method of claim 94 further comprising:  
selectively adding noise to the digital data signal.

106. (Withdrawn) A method for pre-processing a digital data signal to steganographically encode unique copies of the digital data signal, comprising:  
providing a digital data signal; identifying candidate bits of the digital data signal that will be steganographically encoded;  
generating a key on at least one predetermined criterion; and  
manipulating the digital data signal at the plurality of candidate bits with the key.

107. (Withdrawn) The method of claim 106, wherein the step of identifying candidate bits of the digital data signal to be manipulated comprises:  
generating a psychoacoustic model of the digital data signal.

108. (Withdrawn) The method of claim 106, wherein the step of identifying candidate bits of the digital data signal to be manipulated comprises:  
generating a psychovisual model of the digital data signal.

109. (Withdrawn) The method of claim 106, wherein the step of providing a digital data signal comprises providing a digital data signal comprised of compressed digital data.

110. (Withdrawn) The method of claim 106, wherein the step of generating a scrambling key comprises:

generating a unique scrambling key for each authorized copy.

111. (Withdrawn) The method of claim 106, wherein the criterion are selected from the group consisting of a transaction identification, an individual identification, a use limitation, and a signal domain.

112. (Withdrawn) The method of claim 106, wherein a subset of the plurality of candidate bits identified are manipulated with the key.

113. (Withdrawn) The method of claim 106, wherein the step of manipulating the digital data signal at the plurality of candidate bits with the scrambling key comprises: manipulating the plurality of candidate bits with a key to embed a watermark and to add noise to digital signal.

114. (Withdrawn) The method of claim 113, wherein the relationship is at least one of a sequential relationship, a linear relationship, and a logically-ordered relationship.

115. (Withdrawn) The method of claim 106, wherein a subset of the plurality of the candidate bits are selected based upon their ability to survive a predetermined test of robustness.

116. (Withdrawn) The method of claim 115, wherein the function is selected from the group consisting of mapping, error correction, and signal processing.

117. (Withdrawn) A method for creating a copy of a digital data signal, comprising: obtaining a model for the digital data signal; and generating a watermark for the descendant copy of the digital data signal based on at least

one criterion.

118. (Withdrawn) The method of claim 117, wherein the step of obtaining a model of the digital data signal comprises:

generating the psychoacoustic model for the digital data signal.

119. (Withdrawn) The method of claim 117, wherein the step of obtaining a model of the digital data signal comprises:

retrieving a stored psychoacoustic model for the digital data signal.

120. (Withdrawn) The method of claim 117, wherein the step of obtaining a model of the digital data signal comprises:

generating the psychovisual model for the digital data signal.

121. (Withdrawn) The method of claim 117, wherein the step of obtaining a model of the digital data signal comprises:

retrieving a stored psychovisual model for the digital data signal.

122. (Withdrawn) The method of claim 117, wherein the criterion are selected from the group consisting of a transaction identification, an individual identification, a use limitation, and a signal domain.

123. (Withdrawn) A method for pre-processing a digital data signal, comprising:  
providing a digital signal;  
identifying a plurality of candidate bits in the digital data signal that can be manipulated during embedding;  
generating at least one digital watermark message to be embedded based on at least one predetermined criterion;  
selecting candidate bits to manipulate; and

embedding the at least one digital watermark message in the selected candidate bits.

124. (Withdrawn) The method of claim 123, wherein the at least one predetermined criterion includes at least one characteristic of the digital signal.

125. (Withdrawn) The method of claim 123, wherein the step of selecting candidate bits to manipulate comprises:

selecting candidate bits that provide optimal locations for the digital watermark.

B4 126. (Withdrawn) The method of claim 123, further comprising the step of: inverting at least one watermark out of a plurality of embedded watermarks.

127. (Withdrawn) The method of claim 123, further comprising the step of: decoding the at least one digital watermark from the digital data signal.

128. (Withdrawn) The method of claim 127, wherein the step of decoding the at least one digital watermark from the digital data signal comprises: degrading the watermarked digital data signal responsive to an unauthorized attempt to decode the digital watermark from the digital data signal.

129. (Withdrawn) The method of claim 127, wherein the step of decoding the at least one digital watermark from the digital data signal comprises: degrading the watermarked digital signal responsive to fewer than all embedded watermarks being decoded from the digital signal.

130. (Withdrawn) The method of claim 127, wherein the step of decoding the at least one digital watermark from the digital data signal is asymmetric.

131. (Withdrawn) The method of claim 123, wherein a key corresponding each of the at least one watermark comprises a greater number of bits than the corresponding watermark message.

54 132. (Withdrawn) The method of claim 123, wherein a key corresponding each of the at least one watermark comprises the same greater number of bits as the corresponding watermark message.

✓ 133. (Withdrawn) A method for pre-processing a digital data signal to authorize a plurality of unique descendant copies of the digital data signal, comprising:

providing a digital data signal; identifying candidate bits of the digital data signal that will be manipulated during scrambling;

generating a key on at least one predetermined criterion; and

manipulating the digital data signal at the plurality of candidate bits with the scrambling key.

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